

A review of data development and conservation planning by The Nature Conservancy:
**Tools for assessment of biological significance among freshwater wetlands
in the Bristol Bay basin**

Summary: We reviewed conservation planning documents developed by The Nature Conservancy for the mapping and designation of biological significance among riverine and other freshwater wetlands in the Bristol Bay region of Alaska. These documents included: (1) A Conservation Blueprint for Alaska (TNC 2006); (2) Alaska Peninsula and Bristol Bay Basin Ecoregional Assessment (TNC 2004); and (3) the Nushagak River Traditional Use Area Conservation Plan (Nushagak-Mulchatna Watershed Council 2007). These documents represent coarse-scale assessments of ecological, cultural and social values that were developed to inform decision-making and action-planning at the statewide, ecoregional and watershed scales, respectively. One of the most notable findings was that the National Wetlands Inventory, which is the standard for wetland mapping throughout most of the U.S., is largely absent in this area. Finally, we reviewed recently released data that may be useful for further evaluation and mapping of biological values related to wetlands in the Bristol Bay basin.

1. **Alaska Conservation Blueprint:** This effort completed a statewide assessment of biological significance within Alaska which relied on expert review in combination with previously published assessments by The Nature Conservancy, federal and state agencies, and other NGOs. Data that are directly relevant to mapping biological significance of wetlands in Bristol Bay include:
 - a. Vegetation: Advanced Very High Resolution Radiometer (AVHRR) was used to map general distribution of 20 vegetation communities throughout Alaska. While not explicitly a map of wetland habitats, a number of these categories are indicative of wetlands, including “wet sedge tundra”, “moist herbaceous / shrub tundra”, and “open spruce forest / shrub-bog mosaic”.
 - b. Anadromous Fish Database: The best inventory of the freshwater distribution of salmonids and other anadromous fish is the Fish Distribution Database (FDD) administered by ADF&G. This database contains all documented locations of each anadromous species, and in some cases specifies life history stage (e.g., spawning and/or rearing). While these are the best comprehensive data available, there is general agreement that this inventory does not describe the full distribution of anadromous fish, particularly in remote regions of Alaska.
 - c. Cumulative Footprint of Human Activities in Alaska: One outcome of this effort was a comprehensive database to map the cumulative footprint of human activities in Alaska based on 4 parameters: access; mining; logging and energy extraction. The resulting map

and database categorizes the relative intensity and types of human activity throughout the state.

- d. Land Ownership and Conservation Status: Another contribution of this study to statewide conservation planning was the development of an integrated data layer that combined land ownership with a review of management intent to derive an index of conservation management status as applied in the USGS GAP framework.
 - e. A Portfolio of Areas of Biological Significance: A synthesis of data vegetation communities and key focal species (including salmonids) within 32 ecoregions of Alaska yielded a “portfolio” of 219 areas of biological significance (~82 million ha). Specific boundaries were mapped using conservation principles of integration, irreplaceability, and efficiency. Taken together, this portfolio represents a statewide inventory of broad-scale landscapes with important biological resources that warrant effective conservation management.
2. **Alaska Peninsula and Bristol Bay Ecoregion Assessment**: An ecological assessment of the Alaska Peninsula and Bristol Bay ecoregions was initiated in 2000. The primary product of this ecoregional assessment is a “*portfolio*” of areas of biological significance. This assessment is designed to focus conservation work in the immediate future, allowing conservation practitioners to quickly put emerging opportunities into the appropriate ecological context and to take actions that are scientifically defensible and result in highly effective and focused biodiversity conservation. A significant limitation of this work with regard to current issues is that the analytical boundary excluded the Mulchatna River and tributaries that are now part of state mining claims in the region. Nonetheless, a review of geospatial data on biological values may be relevant.
- a. Surficial geology: Based on surveys by USGS (1964) and digitized by the National Park Service (2000). Surficial geology is one of the underlying drivers of hydrologic processes and wetland formation, and thus provides an important input to mapping and description of aquatic ecological systems within the study area. Sample categories include glacial valleys, lightly modified moraines, marine sediments, floodplain and alluvial outwash.
 - b. Anadromous Waters Catalog: A primary input for distribution and life stage of anadromous fish. Available online:
<http://www.sf.adfg.state.ak.us/SARR/AWC/index.cfm/FA/data.contactForm>
 - c. Alaska Habitat Management Guides: A variety of data layers were digitized by The Nature Conservancy from the Alaska Habitat Management Guide Atlas, including beaver, moose, caribou, Arctic grayling, and rainbow trout. This atlas was published in 1985.
 - d. Alaska Natural Heritage Program: A range of species occurrence data were provided by the Alaska Natural Heritage Program. These include location of observations of Beringian marbled godwit, black brant, black scoter, king eider, Kittlitz’s murrelet, long-tailed duck, Steller’s eider and locations of rare plant species.
 - e. Important Bird Areas: Compiled by Audubon Alaska, this data layer represents generalized areas of concentration for seabirds, shorebirds and waterfowl, and describes

activities that occur such as migration, staging, wintering and summer feeding areas.

3. **Nushagak River Traditional Use Area Conservation Plan:** The Nushagak River Watershed Traditional Use Area Conservation Plan is a document prepared under the direction of the Nushagak-Mulchatna Watershed Council to guide conservation related activities within the watershed. The plan proposes four basic strategies to address the foreseeable threats to the important areas within the Nushagak-Mulchatna watershed over the next half-century.

- a. Traditional Ecological Knowledge: The Nushagak-Mulchatna Watershed Council identified key plant and animal resources of traditional importance to the people of the region. These resources included the five species of Pacific salmon that return to the watershed, whitefish, other freshwater fish, moose, caribou, waterfowl and areas important for the harvest of berries and medicinal plants. Over a two-year period, Tim Troll of The Nature Conservancy in Alaska, with translation and interpretative help provided by Molly Chythlook, Daniel Chythlook, Gust Tungjung Jr., and Francisca Yanez, conducted interviews with elders, residents and visitors to the region to determine the places that needed to be preserved in order to protect these resources. This traditional ecological information was mapped and when combined with resource data obtained from federal and state agencies an overall picture of the natural resources within the watershed was developed.

i. <http://www.nature.org/wherewework/northamerica/states/alaska/preserves/art17527.html>

- b. Threats Assessment: Staff and scientists from The Nature Conservancy along with a steering committee selected by the Nushagak-Mulchatna Watershed Council identified the probable threats to the watershed in the next 50 years. The principal threats identified include: commercial development, community development, recreational subdivisions, recreational activities, mining, roads, and global climate change. None of these threats at present appears to be causing serious environmental harm. However, some threats like commercial and recreational development are already having a noticeable impact suggesting that serious harm could occur if action is not taken in the near future. Other potential threats, like mining, are difficult to assess because there is no history of significant mining activity within the watershed. However, mining exploration is occurring and extensive mining may pose a serious threat in the near future because sizeable deposits of minerals have been discovered in the watershed and could be permitted for extraction.
- c. Strategic Action: The following are the four strategic actions of the Nushagak River Traditional Use Area Conservation Plan designed to address the potential threats to the watershed:
- i. Reserve adequate water flow for the Nushagak River and tributaries under existing laws for in-stream flow reservation.
 - ii. Maintain the vegetative complex that supports moose, fish and other species within and adjacent to the floodplain.
 - iii. Maintain water quality standards that protect wild salmon and other fish.
 - iv. Prevent habitat damage that could result from mining.

4. **Other sources of geospatial data:** While these publications were based on the best data available at the

time of their release, availability of geospatial information is rapidly advancing. A brief discussion of newly available datasets, and a preliminary strategy for improved mapping and information related to wetland values in Bristol Bay may be useful.

- a. Mapping of Anadromous Fish in Bristol Bay watersheds: During 2008-2010 The Nature Conservancy has been conducting field surveys to document the presence of anadromous fish and nominate streams to the ADF&G Anadromous Waters Catalog. To date, we have documented presence of anadromous fish in approximately 55 stream reaches (over 92 miles) that were previously unknown. To facilitate this work, we have developed a suite of geospatial data tools and products for viewing these streams in relation to other hydrological studies and proposed development activities.

http://www.nature.org/wherewework/northamerica/states/alaska/files/koktuli_tnc_anad_onsalmon_results_11x17_miles_kms.pdf

- b. Digital Elevation Models: A key advance in geospatial mapping in recent years related to wetland ecology is the improvement of digital elevation models. The standard source of elevation data has been the The National Elevation Dataset (NED) that exists throughout Alaska with a resolution of 60 m (<http://ned.usgs.gov/>) . More recently, the Shuttle Radar Topography Mission (<http://www2.jpl.nasa.gov/srtm/>) provided a digital elevation product with a spatial resolution of approximately 30 m, yet is only available for areas south of 60N latitude. This excludes the headwaters of the Nushagak and Mulchatna River systems, yet does include the location of the proposed Pebble Project. Finally, the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) has produced a more recent elevation model with a resolution of 30m that is complete for the entire Bristol Bay region.

- i. Hydrologic modeling using DEMs and Landsat: The distribution of wetland habitats, particularly those associated with resident and anadromous fish, is a key determinant of biological values in the Bristol Bay region. Nonetheless, the National Wetlands Inventory is not complete, so comprehensive mapping is not currently possible. In southeastern Alaska, we developed an interim solution to map areas with a high level of hydrologic connectivity with existing wetlands as well as anadromous fish. This method combined digital elevation models with Landsat ETM imagery to provide a near-term solution to mapping the full extent of wetlands and anadromous fish until more detailed, longer-term solutions are completed

(http://home.gci.net/~tnc/HTML/maps/fig10_floodplain_model_mid.jpg).

- c. Vegetation and Land Cover Mapping: A newly developed land cover data product called Landfire (<http://www.landfire.gov>) has been developed by a consortium of partners for the USGS GAP program, that combines a systematic description of vegetative communities with classification Landsat ETM imagery. The quality of this product or applicability for the purpose of mapping wetlands in Bristol Bay has not been evaluated, but it is worth investigating.

- d. Subsistence Mapping: The Alaska Dept. of Fish and Game Division of Subsistence is very active in documenting patterns of use of fish and wildlife resources by rural Alaskans that may be useful in assigning biological significance to wetland habitats in the Bristol Bay basin. These include a map atlas of "Harvests and uses of caribou, moose, bears and Dall's sheep by communities of Game Management Units 9b and 17 in western Bristol Bay, Alaska, 2001/2002". Contact Davin Holen, Div. of Subsistence, ADF&G. <http://www.subsistence.adfg.state.ak.us/techpap/tp283.pdf>